Unit 1: Soft Computing & Evolutionary AI

INTRODUCTION

What is intelligence?

Real intelligence is what determines the normal thought process of a human . Artificial intelligence is a property of machines which gives it ability to mimic the human thought process. The intelligent machines are developed based on the intelligence of a subject, of a designer, of a person, of a human being.

Now two questions: can we construct a control system that hypothesizes its own control law? We encounter a plant and looking at the plant behavior, sometimes, we have to switch from one control system to another control system where the plant is operating.

The plant is may be operating in a linear zone or non linear zone; probably an operator can take a very nice intelligent decision about it, but can a machine do it? Can a machine actually hypothesize a control law, looking at the model? Can we design a method that can estimate any signal embedded in a noise without assuming any signal or noise behavior?

That is the first part; before we model a system, we need to observe. That is we collect certain data from the system and How do we actually do this? At the lowest level, we have to sense the environment, like if I want to do temperature control I must have temperature sensor. This data is polluted or corrupted by noise.

How do we separate the actual data from the corrupted data?

These are very important questions that we should think of actually. Similarly, also to represent knowledge in a world model, the way we manipulate the objects in this world and the advanced is a very high level of intelligence that we still do not understand; the capacity to perceive and understand.

What is AI ?

Artificial Intelligence is concerned with the design of intelligence in an artificial device. The term was coined by McCarthy in 1956.

There are two ideas in the definition.

1. Intelligence

2. artificial device

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What is intelligence?

Is it that which characterize humans? Or is there an absolute standard of judgement? Accordingly there are two possibilities:

- A system with intelligence is expected to behave as intelligently as a human
- A system with intelligence is expected to behave in the best possible manner – Secondly what type of behaviour are we talking about?
- Are we looking at the thought process or reasoning ability of the system?
- Or are we only interested in the final manifestations of the system in terms of its actions?

Given this scenario different interpretations have been used by different researchers as defining the scope and view of Artificial Intelligence.

1. One view is that artificial intelligence is about designing systems that are as intelligent as humans. This view involves trying to understand human thought and an effort to build machines that emulate the human thought process. This view is the cognitive science approach to AI.
2. The second approach is best embodied by the concept of the Turing Test. Turing held that future computers can be programmed to acquire abilities rivalling human intelligence. As part of his argument Turing put forward the idea of an 'imitation game', in which a human being and a computer would be interrogated under conditions where the interrogator would not know which was which, the communication being entirely by textual messages. Turing argued that if the interrogator could not distinguish them by questioning, then it would be unreasonable not to call the computer intelligent. Turing's 'imitation game' is now usually called 'the Turing test' for intelligence.
3. Logic and laws of thought deals with studies of ideal or rational thought process and inference. The emphasis in this case is on the referencing mechanism, and its properties. That is how the system arrives at a conclusion, or the reasoning behind its selection of actions is very important in this point of view. The soundness and completeness of the inference mechanisms are important here.
4. The fourth view of AI is that it is the study of rational agents. This view deals with building machines that act rationally. The focus is on how the system acts and performs, and not so much on the reasoning process. A rational agent is one that acts rationally, that is, is in the best possible manner.

Typical AI problems

While studying the typical range of tasks that we might expect an “intelligent entity” to perform, we need to consider both “common-place” tasks as well as expert tasks.

Examples of common-place tasks include

- Recognizing people, objects.
- Communicating (through natural language).
- Navigating around obstacles on the streets

These tasks are done matter of fact and routinely by people and some other animals. Expert tasks include:

• Medical diagnosis.

• Mathematical problem solving

• Playing games like chess

These tasks cannot be done by all people, and can only be performed by skilled specialists. Now, which of these tasks are easy and which ones are hard? Clearly tasks of the first type are easy for humans to perform, and almost all are able to master them.

However, when we look at what computer systems have been able to achieve to date, we see that their achievements include performing sophisticated tasks like medical diagnosis, performing symbolic integration, proving theorems and playing chess.

On the other hand it has proved to be very hard to make computer systems perform many routine tasks that all humans and a lot of animals can do. Examples of such tasks include navigating our way without running into things, catching prey and avoiding predators.

Humans and animals are also capable of interpreting complex sensory information. We are able to recognize objects and people from the visual image that we receive. We are also able to perform complex social functions.

Intelligent behaviour

This discussion brings us back to the question of what constitutes intelligent behaviour. Some of these tasks and applications are:

1. Perception involving image recognition and computer vision

2. Reasoning

3. Learning

4. Understanding language involving natural language processing, speech processing

5. Solving problems

6. Robotics